



Antioxidants and Oxidative Stress in Cows



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Abstract

The aim of this review is to present antioxidants and oxidative stress in cows during lactation as biological health markers. Identification of health markers is useful tool to show an effect of foreign chemical substances and their effects on different changes in the body. Investigation of various biomarkers of oxidative stress related to various health issues in dairy cows is important. The biological health markers of animals have significant dependence on the modifications in components of biochemical and hematological processes. Numerous biochemical parameters are affected by different variables as animal breeds, age, development, gestation status and production status. Disturbance in feed intake and rise in metabolic processes lift oxidative stress in cows especially during pregnancy and at peak lactation may be determined by supervising blood alterations.

Keywords: Cows; Lactation; Oxidative stress; Antioxidants

Introduction

The biological health markers of animals have significant dependence on the modifications in components of biochemical and hematological processes. Numerous biochemical parameters are affected by different variables as animal breeds, age, development, gestation status and production status [1,2]. The biochemistry of blood is estimated significantly in order to evaluate cattle health status. This estimation of blood biochemistry is required to identify numerous pathological, physiological and metabolic problems of dairy animals. The fertility and reproductive cycle of the dairy cattle is affected by some key nutrients as blood glucose, cholesterol and protein [3,4]. Oxidative stress is a phenomenon of cellular degradation as a result of boosted oxidant release in animal body cells because of release of free radicals. This condition of chemical stress arises as the release of such free radicals within body cells goes beyond its ability to neutralize and remove those [2]. In recent studies, veterinarians are taking keen interest to find out various antioxidants in animals for remedial intention [5]. As there are many biochemical markers that monitor stress caused by oxidation but now several diagnostic procedures are being used to evaluate only total antioxidant status (TAS) because it is difficult to assess each antioxidant constituent independently as well as their relations with other serum components [6].

Malondialdehyde (MDA) is preferred as a best indicator of reactive oxygen species and detector of the free radicals of oxygen

released during abnormal functioning of different tissues [7]. The main function of this enzyme (SOD) is to change superoxide radical into oxygen molecule and H₂O₂. The reaction proceeded and then catalyzed by the enzymes catalase and peroxidase to change H₂O₂ (hydrogen peroxide) into water and oxygen [8]. Catalase is recurrently utilized by cells to quickly catalyze the reaction of H₂O₂ to break into less-reactive oxygen gas and molecules of water. Any disturbance in antioxidant balance can cause oxidative stress. A variety of disorders are quickly happened by such type of imbalance. Paraoxonase (PON1) as an antioxidant molecule on HDL has ability to eliminate oxidized lipids both on HDL and LDL. In this way, it participates in antioxidant mechanisms. Measuring serum PON1 activity of dairy cattle during different lactation stages could be a useful diagnostic tool, helping to obtain better health assessment during high milk production [9]. Both serum esterase enzymes (PON1 and Arylesterase) proceed as lipophilic antioxidants in living beings [10]. Collectively, both esterase enzymes in the form of single enzyme catalyze the chemical reactions [11].

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Antioxidants are those substances that prevent or removed the oxidative damage [12]. These antioxidants act as a defense system. This defense system may be enzymatic defense or non-enzymatic defense system. Enzymatic may be superoxide dismutase, GSHPx and Catalase and non-enzymatic are vitamin C, vitamin E and selenium. When the production of reactive oxygen

species and free radicals are produced in huge amounts, then the antioxidant defense becomes weak. Due to the decreased antioxidant defense system, biological molecules damaged and disturbed the normal physiological and metabolic mechanism. Naturally free radicals in living organisms are produced and reactive oxygen species are also produced. Under normal situation prooxidant and oxidants balance each other when the equilibrium is disturbed as a result harmful effects produced. When near the time of parturition antioxidants decreased, ROS are produced faster thus led to oxidative stress in cattle [13]. During oxidative stress radicals or ROS are capable to damage biological macromolecules, such as lipids, proteins or DNA, possibly disturbing and disorderly physiological metabolism [14]. Next to the damage done to lipids and other macromolecules, ROS might also change cellular membranes or other components leading to changes in physiological pathways and perhaps even causing pathology [14]. Thus, the oxidative stress is not act as diseases and does not explain a precise clinical picture. It observed that when animals have high metabolism; experienced an oxidative stress and due to oxidative stress other metabolic expected diseases may be diagnosed. The injury of macromolecules due to oxidants and the substances that are enzymatic and non-enzymatic are very helpful tools for the oxidative stress in animals and the position of antioxidants.

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